# APPLICATION

# FOR

# UNITED STATES LETTERS PATENT



TITLE: CLEAR PLASTIC PACKAGING IN A CMOS ACTIVE PIXEL IMAGE SENSOR

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# CLEAR PLASTIC PACKAGING IN A CMOS ACTIVE PIXEL IMAGE SENSOR

The present application claims priority under 35 USC 119 from Provisional Application number 60/111,597, filed November 18, 1998.



## Background

Image sensors typically are formed using some kind of clear portion to allow light photons to enter the package. Other packaging techniques use plastic injection molds, blown plastics, or plastic transfer molds.

These techniques use a flow of plastic packing compound into a cavity. The cavity includes the dye to be packaged, on a lead frame. Once cooled, the package part is removed from the mold, and the leads are trimmed or formed to form the final packaged part.

Typical materials used in the molding have been opaque. These materials block incoming light. Hence, when these materials are used to package an optical component, they must be used in a way that does not interpose packaging material between the light and the component.

These systems have been used with a preformed plastic cavity or leadless chip carrier. Using these forms, however, has meant into a higher package cost.

## Summary

The present application teaches packaging a photosensitive device in a clear package. More specifically, the photosensitive device can be a CMOS image sensor that is packaged in clear QFP or acrylic. The clear material allows the CMOS image sensor to be packaged in the same way as any other CMOS device. Since the material used to package the device is clear, however, the image sensor can be directly packaged in the package.

## Brief Description Of The Drawings

These and other aspects will now be described in detail with respect to the accompanying drawings, wherein:

Figure 1 shows a chip packaging system;

Figure 2 shows the device receiving incoming light; and

Figure 3 shows a double sided image sensor.

## Detailed Description

The standard cavity mold approach used in CMOS is used according to the present application. The package is formed totally of clear structural plastic, such as QFP, or

an acrylic. The transfer mold approach is used in its standard way, but modified to use the melting and/or flow temperature for the QFP. The pressure and time in the mold are also modified according to the manufacturer's recommendations. The mold forming cavity may also be modified to allow for features which allow for the different viscocity of the clear mold compound.

The final device forms a standard type CMOS die in a totally clear package as shown in Figure 1. The CMOS die, is, for example, a photosensitive device with electrical connections, for example, an active pixel sensor. The perimeter of the device has electrical connections, which are connected to the electrical connections on the image sensor chip.

An interesting reason for doing this is for the reasons shown in Figure 2. Incoming light photons such as 200 impinge on the photodetector 199. These are often accumulated in the silicon substrate under the photogate PG as 202, 204. The accumulated photons are stored as charge or some other form, which can be later read out. However, if the whole package is clear, as shown in Figure 2, then the accumulated photons can be received from any conceivable angle, such as the angle shown as 205 in figure

2. A window, which would presumably be in the area shown as 210 in Figure 2, would presumably block that photon.

Another application is shown in Figure 3. The device is packaged with two image sensor elements 300 and 310 which respectively receive incoming light from two different sides 315, 317. Another image sensor 312 can receive light from the top 320. Since the package 299 is clear, the image sensors can be freely located within the package perimeter to receive incoming light from any direction.

Other modifications are contemplated. For example, other clear materials may be usable for packaging the chip.